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WESTERN BUDWORM

MAJOR DEFOLIATOR OF
CONIFEROUS TREES



U. S. DEPARTMENT OF AGRICULTURE
FOREST SERVICE/NORTHERN REGION
MISSOULA, MONTANA



Adult western budworm moth, resting on fir needles.

The Insect

To entomologists, the western budworm is *Choristoneura occidentalis* Freeman. The adult is a mottled, buff-colored moth, about three-fourths of an inch long. Like many insects, the western budworm has four stages of development: (1) egg, (2) larva, (3) pupa, and (4) adult moth.

CATERPILLAR

As tiny larvae (small caterpillars), budworms spend the colder months under bark scales and other sheltered spots on the host trees. In late May, the larvae move to find food. If tree buds haven't begun to grow, the larvae mine the inside of old needles. They usually feed on new foliage until the middle of July. By this time, they have grown from the size of a matchhead to about 1 inch in length.

MOTH

During mid-July, the caterpillars lightly web needles together and go into a resting stage. After changing into the pupal stage for 10 to 12 days, they emerge as moths. The mottled

brown moths are about three-fourths of an inch long. The females are usually too heavy with eggs to fly far, so most of the eggs are laid on foliage nearby. Female moths lay 10 to 50 eggs per mass on a needle. The pale green eggs overlap one another, somewhat like fish scales. Larvae hatch from the eggs in about 10 days. The new caterpillars hibernate almost immediately, thus completing the western budworm's life cycle.

History The budworm is native to this continent. It was first detected in the West about 1915. Forest Service records show that, until 1942, budworm outbreaks were of short duration in the National Forests of the Northern Region. Outbreaks subsided from natural factors and caused little tree mortality. An 8-year outbreak started in the Bob Marshall Wilderness of Montana in 1942 and spread over 200,000 acres. Tree mortality was extensive.

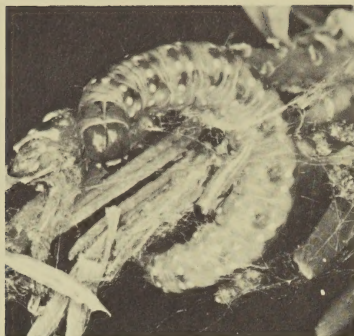
Since 1950, budworm infestations have occurred more frequently. By 1958, more than 4-1/2 million acres of Douglas-fir type were heavily infested in southwestern Montana. The degree of infestation was reduced by aerial sprays, but 2 million acres in the Northern Region were still infested in 1963.

Infestations appeared west of the Continental Divide in the early sixties. In 1968, 4.2 million acres showed evidence of damage. Budworm infestations now extend west from Montana's Stillwater River, south to the Salmon River in Idaho, and northeast from Riggs, Idaho, to Bigfork, Montana.

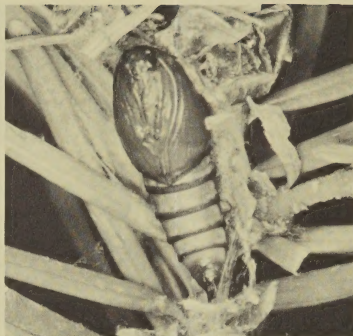
INVADE NEW AREAS

Budworms invade new areas when moths fly during the last part of July. Moth flight usually occurs in the late afternoon and evening. City lights often attract myriads of moths. Winds and updrafts have transported moths as far as 50 miles. First and second instar larvae can also be transported by winds.

What It Does In Montana and Idaho, the budworm prefers Douglas-fir, grand fir, subalpine fir, and Engelmann spruce. Larvae feed to a lesser extent on western larch, lodgepole, ponderosa, and western white pines, and western hemlock.



Full-grown western budworm caterpillar, feeding on new fir needles. Notice silk webbing.



Pupal or resting stage of western budworm. Cocoon of webbed needles, opened up to reveal insect.



Egg mass of western budworm along fir needle.

TREE MORTALITY

Caterpillars, emerging in the spring from their overwintering sites, may mine old needles, but prefer current season's growth as soon as it is available. Successive years of feeding may cause tree mortality. Young trees are usually the first to die. Continuous light feeding reduces growth and weakens trees and can make trees susceptible to attack by bark beetles and diseases.

SEED LOSS

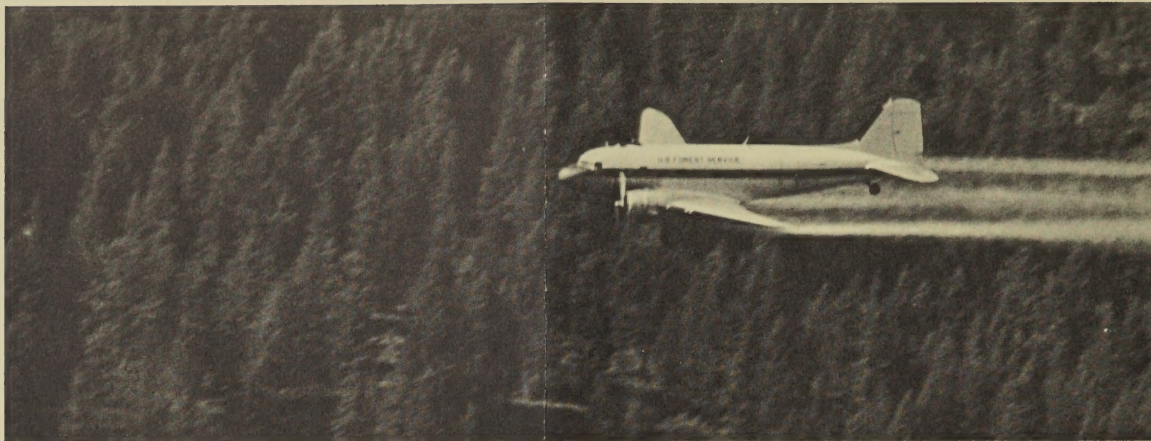
Studies in 1967 indicated western budworm was a major pest of Douglas-fir cones in east-

ern Montana. In one area, the insect damaged more than 70 percent of the cones. Western larch cones and seeds in western Montana are sometimes completely destroyed. Loss of seeds has severely curtailed natural reforestation.

Western budworm caterpillars have severed stems of sapling-sized western larch shoots. This produces multiple leaders and crooked boles. Heavy budworm feeding restricts the harvest of Douglas-fir and other Christmas trees. The defoliation reduces the esthetic value of trees in recreational areas.

Stand of Douglas-fir in eastern Montana which has been heavily defoliated by western budworm for several years. Grayish trees are dead.





DC-2 spraying a stand of Douglas-fir with Zectran to control western bud

What is being done?

Surveys — Maps, based on aerial surveys, are prepared annually to show the extent and degree of budworm defoliation. Survey maps are used in planning spray programs and to maintain accurate records of infestation. Budworm populations are evaluated by collecting branches from infested areas and counting the egg masses. At the same time, entomologists determine the percentage of budworm defoliation to predict the next year's defoliation.

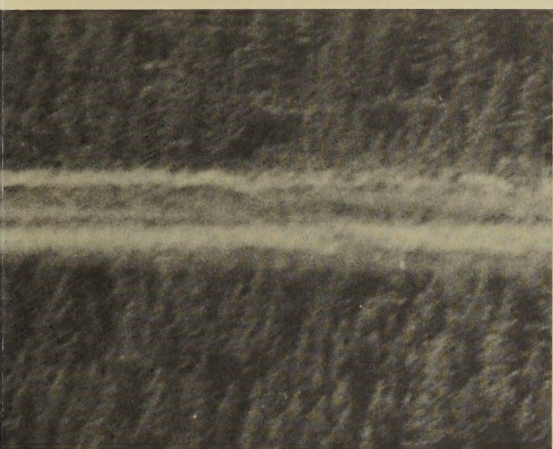
Research — Basic research is being conducted on the relationship between the budworm and its various hosts, the variety of budworm species, the budworm's eating habits, and the economic impact of budworm damage.

Natural Control — Parasites, predators, diseases, adverse climatic conditions, and starvation all affect budworm populations. In the western United States, there are about 35 species of primary parasites (wasps and flies) that kill the budworm. Spiders, ants, beetles, and many birds feed on budworms. Only a few bacteria and viruses kill the insect. Aerial spraying of bacteria has been tried with some success. Sudden, below freezing temperatures

can kill caterpillars when they are just starting to feed in the spring.

Applied Control — Insecticides applied from the air are the most common method for reducing western budworm infestations. An organic phosphate — Malathion — gave excellent budworm control in a 1966 project near Dillon, Montana, when applied at a rate of 8 ounces per acre. While Malathion breaks down in water in about 7 days, it is highly toxic to many aquatic insects. Other nonpersistent insecticides are being investigated and tested. A chemical called "Zectran," tested since 1964, gives satisfactory results. It was applied on several thousand acres during 1966 and 1968. When applied at the rate of 1 ounce of Zectran (6 percent by volume) in 1 pint of carrier per acre in 1968, no direct effects were observed in birds, small mammals, fish, or aquatic insects. On the basis of all trials to date, this material may become available for aerial application by 1972.

Aerial sprays are usually applied about July 4 in Montana, when 95 percent of the budworm caterpillars are in their fourth, fifth, and sixth stages of development. At this time, they are still feeding and have not gone into nests that protect them from the spray of droplets.



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**and PLEASE
make people
more careful**



Collecting Douglas-fir foliage to sample number of western budworm egg masses.

